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### (5) Paper thickness detecting apparatus.

(57) There is disclosed a paper thickness detecting apparatus comprising :  
an electrode detecting unit constituted by a ground electrode and a detecting electrode arranged in upper and lower positions of a running path of paper to oppose each other ;  
an oscillating circuit for generating an oscillation frequency signal ;  
a resonant circuit for shifting a resonance point in response to a change in electrostatic capacitance corresponding to a change in paper thickness detected by said electrode detecting unit, and  
a detecting circuit for detecting an output of said resonant circuit.

fore, information indicating, e.g. a paper thickness, overlapping of sheets of paper, a paper length, or a deviation between overlapped sheets of paper can be detected with high sensitivity, high precision, and high reliability, resulting in a very large technical value.

## Claims

1. A paper thickness detecting apparatus comprising:
  - an electrode detecting unit constituted by a ground electrode and a detecting electrode arranged in upper and lower positions of a running path of paper to oppose each other;
  - an oscillating circuit for generating an oscillation frequency signal;
  - a resonant circuit for shifting a resonance point in response to a change in electrostatic capacitance corresponding to a change in paper thickness detected by said electrode detecting unit, and
  - a detecting circuit for detecting an output of said resonant circuit.
2. A paper thickness detecting apparatus according to claim 1 wherein a high-impedance converting circuit is connected between said oscillating circuit unit and said tuning circuit.
3. A paper thickness detecting apparatus according to claim 1 further comprising an amplifying circuit for amplifying an output of said detecting circuit.
4. A paper thickness detecting apparatus according to claim 3 further comprising an AFC circuit for controlling gain of the output of said amplifying circuit.
5. A paper thickness detecting apparatus according to claim 1 wherein both said oscillating circuit and said tuning circuit include ceramic resonators.
6. A paper thickness detecting apparatus according to claim 1 wherein said oscillating circuit comprises an oscillating circuit unit and a high-impedance converting circuit.
7. A paper thickness detecting apparatus according to claim 1 wherein said detecting circuit comprises a high-impedance circuit and a signal detecting circuit for envelope-detecting an output signal from said resonant circuit.
8. A paper thickness detecting apparatus comprising:
  - a detecting unit including first and second detecting electrodes arranged along a running

- 5 path of paper;
- 10 a signal oscillating circuit for generating an oscillation frequency signal;
- 15 a first sensor circuit for shifting resonance point in response to a change in electrostatic capacitance detected by said first electrode detecting unit;
- 20 a second sensor circuit for shifting a resonance point in response to a change in electrostatic capacitance detected by said second electrode detecting unit; and
- 25 an output circuit for outputting a signal indicating a difference between the detection signals from said first and second sensor circuits.
- 30 9. A paper thickness detecting apparatus according to claim 8 further comprising means for connecting said oscillating circuit and said first and second sensor circuits.
- 35 10. A paper thickness detecting apparatus according to claim 8 wherein each of said first and second sensor circuits includes a resonant circuit and a detecting circuit.
- 40 11. A paper thickness detecting apparatus according to claim 9 wherein said connecting means is a distributor for distributing said oscillation frequency signal to said first and second circuits.
- 45 12. A paper thickness detecting apparatus according to claim 8 wherein said detecting unit comprises said first and second detecting electrodes and a common ground electrode to oppose each other with respect to a passing space of a paper.
- 50 13. A paper thickness detecting apparatus according to claim 8 wherein said output circuit comprises a differential amplifier.
- 55 14. A paper thickness detecting apparatus according to claim 10 wherein each sensor circuit includes an amplifying circuit for amplifying a signal from said detecting circuit and AFC circuit to prevent a resonance point of said resonant circuit from falling outside a set frequency range.

## **CONCISE EXPLANATION OF RELEVANCE**

EP 0635696 B1 describes a device for the electronic measurement of the thickness of thin webs or sheets, in particular foils, films or paper sheets, consisting of a fixed supporting surface and a tactile sensor arranged in fixed manner and substantially perpendicularly to this supporting surface and having a ferromagnetic tactile member which is movable relative to the supporting surface and, as a function of its position relative to the supporting surface, influences the signal of an inductive transducer in the form of a sensor coil and thus indicates the thickness of the webs or sheets.

